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GRAPES IN OKLAHOMA

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GRAPES IN OKLAHOMA

This publication was undertaken because of the increasing interest in grape culture as shown by the large number of inquiries received at the Oklahoma State Experiment Station at Stillwater and the U. S. Field Station at Woodward, Oklahoma. Experimental vineyards including many varieties most of which are found in the tests at both stations have shown that many of the varieties not commonly planted in Oklahoma may be grown profitably. Although the grape has not in the past been produced in large commercial quantities in Oklahoma these tests have indicated that climatic and soil conditions are favorable for the production of many varieties of grapes on a commercial scale. The object of this bulletin is to call attention to these varieties and to give directions for their selection and production.

CHOOSING THE VINEYARD SITE

Moderately fertile, well drained soils are most suitable for the growing of grapes. A high percentage of sand is desirable in the surface with a sandy or gravelly clay subsoil underneath. There should not be so much clay in the subsoil that it will become water logged or hinder drainage. However, experience has shown that, while clay is desirable underneath the surface, it is by no means essential to the successful production of good crops. The heavy clay soils which are usually characterized by poor drainage sometime during the year are not suitable for the commercial production of grapes. A vineyard planted on such soil cannot yield the profits that could be expected from a vineyard planted on a good, well drained, sandy loam, and will always suffer from drought during hot, dry seasons. Soil with hard pan or bed rock within four or five feet of the surface is undesirable. If the vineyard is located on a northerly slope having suitable soil conditions better protection from wind will be afforded than if the vineyard were located on any other slope.

Age of Plants

One year old plants are more economical for starting a vineyard, although two year old plants which are always more expensive, are sometimes used. Strong, vigorous one year old plants are satisfactory for general use. Small, weak plants are frequently offered for sale at a low figure but the farmer who uses such plants will find them to be the most expensive in the end.

Laying Out the Vineyard

In laying out the vineyard the ideal direction for the rows would be to extend from the southwest to the northeast. This would allow the prevailing winds to pass down between the rows with the least disturbance to the



FIG. 1—ONE YEAR OLD VINE PRUNED
IMMEDIATELY AFTER PLANTING

vines and give practically an even distribution of sunlight to both sides of the vines on the trellis. Because of the additional number of end posts required and the number of short rows which make cultivation more difficult this arrangement is not always practical. The next best and probably usual arrangement is to run the rows north and south. The least desirable arrangement is to run the rows from east to west, as this gives the poorest possible distribution of sunlight and the greatest damage by wind.

The distance between the rows should be ten feet in a commercial vineyard. For the home vineyard this distance may be varied, to a certain extent, depending on the cultivation implements available. However, the rows should never be closer than eight feet. Many people make the mistake of planting the rows too close together. This is undesirable because it does not allow sufficient room for cultivation and also limits the moisture supply for each vine. It also may make it impossible to get between the rows with wagons and sprayers.

It is essential that the rows be straight because any plants which are out of line are very apt to be injured in cultivation. If the prospective vineyard is small the rows may be established by the use of a line and stakes but in planting a commercial vineyard it is customary to establish the row by means of a plow or a lister. The distance between the rows should be carefully measured so that the width will be uniform. This is important for ease of cultivation. The distance between the plants in the row may be established by a series of cross furrows. This method of estab-

lishing the rows and the position of the plants in the row will do away with a large amount of digginig which would otherwise be necessary in getting the plants into the soil.

Best Time for Transplanting

Over the western portion of the state spring transplanting usually gives better results than fall transplanting. The reason for this is that the precipitation during the fall and winter months is very limited. The dry condition of the soil together with the colder temperatures which often prevail over that portion of the state makes fall planting extremely hazardous. February or early March planting is desirable provided there is sufficient moisture in the soil. In the central and eastern part of the state fall planting usually gives better results than spring planting unless the soil is very dry. Planting during the months of November and early December is the most desirable practice. When there is a deficiency of moisture in the soil during the fall, planting should be delayed until the following February or March; or it may be done at any time during the winter when the soil is moist and not frozen. Late spring planting under any circumstances is not advisable.

Care In Handling and Transplanting

When the plants are received the box or bundle should be opened immediately and the plants heeled in unless it is possible to plant at once. In heeling in a trench should be dug deep enough so that all of the roots may be covered to a depth of three or four inches. The roots should be separated and the soil worked down between them. The soil should be compacted after the roots have been covered. If the soil is dry the plants should always be watered when the roots are about two-thirds to three-fourths covered. Fill the ditch with water and let it settle before completely covering the roots. Care should always be exercised to prevent the roots drying out while the plants are being transplanted. The roots should never be exposed to sun or wind, but should be protected by covering with wet burlap or soil. The plants may be hauled to the field in a tub or barrel of water.

A shovel or spade will be required for digging the holes to receive the plants. The holes should be made deep enough so that after completely filling, the plants will be covered an inch or two deeper than they stood in the nursery row. The roots should be separated and spread out in transplanting and the soil worked well between them. After filling in with loose soil until the hole is about two-thirds full the soil should be thoroughly compacted by tramping with the feet or tamping with the shovel handle. This tamping or compacting of the soil is very important and should never be neglected because it helps to establish the moisture connection of the roots with the soil. After the soil has been thoroughly compacted the hole should be filled level with the top of the ground and again compacted in the same manner. Loose soil should then be thrown on top. Care should be exercised to get the plants in straight rows which may be accomplished by sighting down the row. A little care at this time will save considerable trouble and expense later on.

Parts of the Plant

A number of terms which may be unfamiliar are used in naming the various parts of the plant. These are briefly defined as follows:

Stock or stem or trunk—main stem or permanent upright part of the plant.

Head—the portion of the trunk adjacent to the wire of the trellis.

Shoot—the immature growth of the season; becomes a cane at the end of the growing season.

Cane—one year old growth arising from the trunk.

Fruit bud—buds which produce shoots upon which the fruit is formed; they develop during the summer at the base of leaves; they are found on the cane during winter at pruning time.

Pruning—cutting out and removing the portion of the vine not required for fruit production.

Training—arrangement of the vine on the trellis.

Pruning at Planting Time

When the plants are received from the nursery the tops will consist of one or more canes. Select the straightest and best of these canes, prune this back to two buds and remove all of the other canes. All that is left above the surface of the ground after planting is the stub with two buds. This type of pruning is necessary to establish a balance between the roots and the top of the plant. Many of the roots are broken off and lost when the plants are dug and if the top is not reduced, the root system will be unable to supply a sufficient amount of moisture to keep the plant growing. Unless the plants are pruned at transplanting time there will be danger of losing a large number of plants. This pruning of the young plants may be done at any one of several different times; (a) when unpacking and heeling in; (b) when taking them up for planting in the prospective vineyard; (c) as they are planted; or (d) after planting is completed. It is easier to establish straight rows when the plants are pruned before transplanting. Taking everything into consideration, it is perhaps best to prune the plants as they are being heeled in. There is less damage at this time from root exposure and drying. Transplanting will be more rapid if pruning is done at that time. If one should plan to prune after the plants are set in the field it will be necessary to walk over a considerable area of ground in order to prune all of the plants. This makes considerable more work and in addition there is danger of getting crooked rows by sighting over unpruned plants.



CULTIVATION AND SOIL MANAGEMENT

Thorough cultivation should always be practiced. Its object is to aerate the soil and also to retain moisture by keeping down weeds and by establishing a soil mulch. In commercial work special implements adapted to vineyard cultivation should be provided. In large vineyards cultivation is probably accomplished more economically by the use of a small tractor and tandem disc. In smaller vineyards an orchard disc of the reversible type is a desirable implement which may be handled with a team. Adaptations of

the spring tooth harrow are sometimes used for summer cultivation. If the vineyard is small effective cultivation may be accomplished by the use of one horse cultivators. A plow is frequently used for breaking the soil at the beginning of spring cultivation. This is especially true when a cover crop is grown and when small implements are to be used later. The grape hoe is sometimes used for cleaning out the row between the plants. The frequency of cultivation will depend to a considerable extent upon the rainfall and upon the type of soil. If the soil is at all inclined to crust after rains the vineyard should always be cultivated as soon as the soil is dry enough and before the crust forms. This practice destroys many weeds before they grow large enough to do any damage. It is always desirable to cultivate after a rain. Cultivation should be continued until the crop is harvested or a cover crop planted. Cultivation then will consist in plowing or thoroughly discing the soil in the spring at or just before the time when growth begins. If discing is practiced the disc harrow should be weighted if necessary to produce a good loose soil mulch. If a plow is used harrowing should follow immediately in order to smooth down the surface thus preventing excessive evaporation and loss of soil moisture. Subsequent cultivation should consist of using the type of implements selected for the work, frequently enough to keep down all weed growth and at all times maintain a soil mulch two or three inches in depth. This should be continued until about the first of September or until fall rains put sufficient moisture in the soil to start a cover crop.

It is usually desirable to sow a cover crop every year about the first of September or as soon thereafter as the soil contains sufficient moisture to germinate seed and maintain growth. The cover crop is planted for the purpose of maintaining the humus content of the soil and also for the purpose of using up any surplus moisture which may be in the soil during the fall. The humus content of any type of soil is rapidly depleted under continuous cultivation in Oklahoma. Depletion of the humus affects soil fertility and at the same time lowers the capacity of the soil for holding moisture. Fall rains frequently add enough moisture to the soil to start a secondary growth of the vines. This growth frequently starts from buds which should not under normal conditions start growth until the following spring. There are two objections to this type of growth. One because a portion of the growth is practically always killed during the winter and the other because such growth makes it difficult to properly prune the vines during the winter and get a proper distribution of fruit buds. If this secondary growth is very much in evidence it may greatly reduce the production of the vines the following year. If a cover crop is planted in time to take up the surplus moisture in the soil this secondary growth may be prevented. On light soils in the portions of the state where high winds are prevalent during the winter and spring months a well established cover crop serves the additional purpose of preventing soil movement. Under these conditions it may be necessary to let the cover crop stand slightly later in the spring than would otherwise be desirable because of the protection it gives to the soil.

Wheat or rye is commonly used as cover crops and is perhaps the most reliable for all conditions in this state. The rate of seeding should be de-

terminated to some extent by the best practice for each of these crops in various localities of the state, using one or two pecks more per acre for starting a cover crop than would be used to produce a grain crop. This is especially desirable where there is danger of the soil blowing. The general practice is to use from three to five pecks of wheat or from four to six pecks of rye per acre. Oats is sometimes used as a cover crop and is generally seeded at the rate of six pecks per acre. Winter or hardy vetch may be desirable in the eastern and central parts of the state. It is a leguminous plant and has the advantage over the others mentioned of adding nitrogen to the soil. It is sometimes used in combination with wheat or rye at the rate of 15 to 20 pounds per acre. When vetch is used in combination with wheat or rye the amount of wheat or rye used for seeding should be reduced one-third to one-half. The cost of vetch is the greatest drawback to its use.

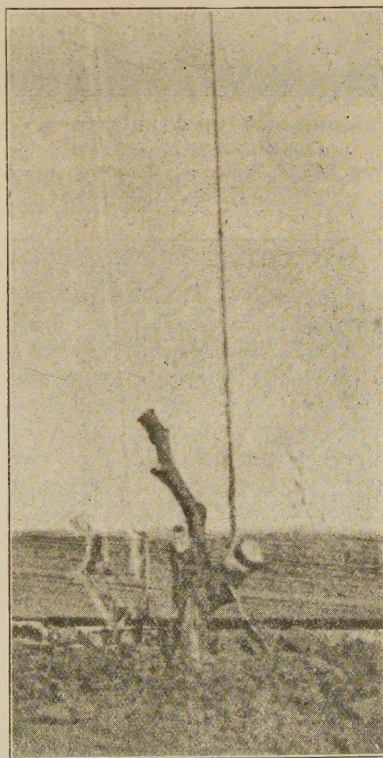


FIG. 2—YOUNG PLANT PRUNED AFTER FIRST SEASON OF GROWTH. THE TWINE SHOWS METHOD OF TYING.

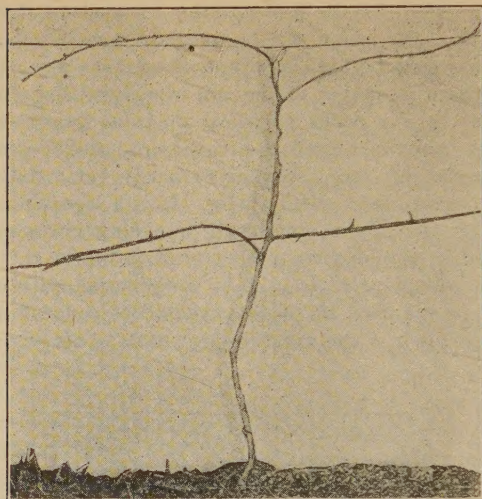


FIG. 3—SHOWING VINE PRUNED TO FOUR
CANE KNIFFEN SYSTEM
After the Second Season of Growth. (Reproduced
From Cir. 20, Mo. Fruit Station)

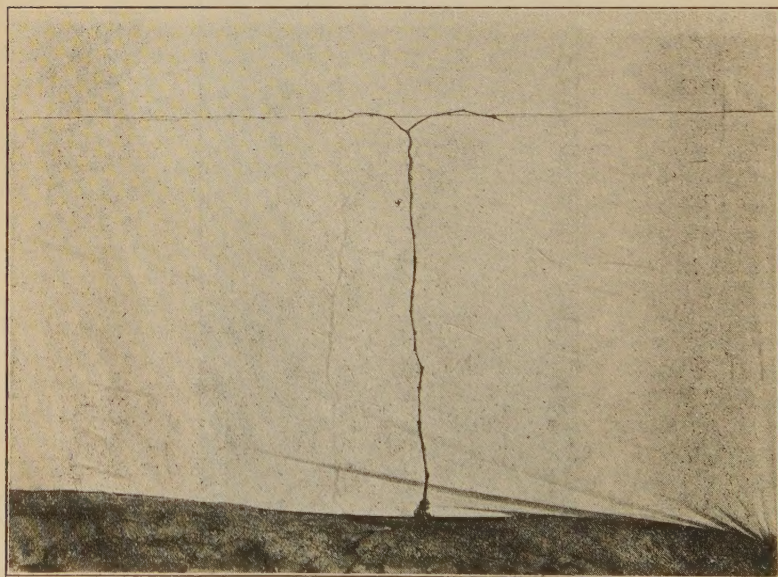
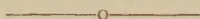


FIG. 4—SHOWING VINE PRUNED TO MUNSON OR CANOPY SYSTEM, AFTER THE
SECOND SEASON OF GROWTH

Pruning at the End of the First Year of Growth

Except under unusual conditions the young plants will have been allowed to grow through the first season with no pruning or training since they were pruned at planting time. The pruning at this time should be done fairly early in the dormant season. The vines before pruning should consist of several canes. The straightest cane of good size should be selected and cut back to two buds. All other canes should be entirely removed with a single exception; one should be cut to a short stub on which there are no buds and to which twine may be tied for the future training. If this stub is not left it will be necessary to use a stake in the future training of the vine. The appearance of the vine after this pruning has been completed is illustrated by Fig. 2.



THE TRELLIS

How to Construct the Trellis

It will be necessary to construct the trellis on which the vines are to be trained before the second season of growth starts. Before construction begins it will be necessary to select the type of trellis to be used. There are two types which are commonly used in Oklahoma, namely, the Munson or Canopy system and the Four Arm Kniffen system. These two systems differ in the arrangement of the wires on the post and in the distribution and arrangement of the canes and shoots on the trellis, as shown in Figs. 3 and 4.

The Munson or Canopy Trellis

The Munson trellis consists of three wires running parallel, the center wire running through holes in the posts at a distance of four feet above the surface of the ground. The other wires are outside of and above the wire which runs through the posts. These wires are supported by cross arms which are attached to the posts. The length of the posts will depend upon the depth that it is necessary to set them in the ground in order to have them hold solidly. The posts should be of some durable wood. As mentioned above, the center wire should be four feet above the surface of the ground and at least four inches should be allowed above this height for attaching the cross arm. The arm should be two feet in length and may consist of a one by four, or preferably two by four. The initial expense of the two by four will be somewhat greater. There are various ways of attaching the cross arm. It may be bolted or nailed to the post or it may be wired to the post with a wire running around the center of the cross arm and the top of the post; brace wires must then be run from the end of the cross arm to a point lower down on the post. Probably the only advantage of fastening the cross arms to the post with wires is that it makes them slightly more flexible and not quite so easily broken when hit by horses or tillage instruments. It possesses the disadvantages of being much more difficult to erect and takes more time. The brace wires are likely to be caught and broken

by various tillage instruments. These wires are also likely to interfere more or less with handling spray rods in spraying the vineyard and to be more or less in the way when moving around under the vines in picking. Fastening the cross arms with nails is probably the cheapest and quickest method of attaching them to the posts; in addition to this it possesses none of the disadvantages mentioned above. Attaching the cross arms with bolts requires that holes be bored both through the post and the cross arms. The bolts of course are slightly more expensive than the nails. Otherwise this method possesses the same advantages as fastening the cross arms with nails and the additional one that they can be very easily tightened up or replaced if necessary. In erecting the Munson trellis the holes in the post can be bored more easily before the posts are set in the ground. In setting the posts, however, care must be taken to place them so that the holes will run in the direction of the row. There are several methods of attaching the wires to the cross arms. Two of the best methods probably are running the outside wires through holes about one inch from the ends and one inch from the top of the cross arm, or merely running the wires over the top of the cross arm and loosely stapling them within about an inch of the ends. This latter method of course makes replacements much simpler. The center wire on the Munson trellis should be number nine or ten, preferably the heavier, especially on a long trellis. Number twelve wire should be satisfactory for the outside wires. The end posts should be set at least two and one half feet deep, and well braced. The cross arms on the end posts should not be lighter than two by four material. These cross arms should be placed on the outside of the end posts so that the pull of the wires will be against the posts. The center wire should be wrapped around the end posts and fastened securely. The outside wires should be wrapped around the ends of the cross arms and also fastened securely. The wires are not fastened tightly at any other place. However, in long rows it may be well to set a heavy post in the center and wrap the center wire around it and also fasten the outside wires to the cross arm on this post. This should relieve the end posts of some strain.

The Four Arm Kniffen Sytem

The Kniffen trellis consists of two wires supported by posts. The lower wire should be stapled to the posts approximately 30 inches from the ground, and the upper wire about twenty-four inches above the lower wire. This places the top wire at approximately fifty-four inches from the ground, making it necessary to use six and one-half or seven foot posts for the construction of this trellis. The posts should be of durable wood and should be set in the ground a depth of one and one-half feet, or deep enough to make sure that the trellis will not be blown down by storms. The end posts should be set about two and one-half feet in the ground, should be of heavier material than the inside posts, and should be well braced, in order to prevent sagging and consequent loosening of the wires. The wires should be firmly stapled to the end posts and it is a good idea to bring the loose end entirely around, making a loop so that it will be impossible for it to pull loose. Two or three staples will be required for each wire in the end posts. In stapling the wire

to the inside posts the staples should not be driven down tightly on the wires, but left loose enough so that the wire will pull through them when tightening becomes necessary. The wires should always be placed on the windward sides of the posts, or if the vineyard is constructed on a slope they should be placed on the uphill side, otherwise they will exert a direct pull on the staples which will loosen and pull out. Number nine or ten wire should be used for the top. Number eleven or twelve is heavy enough for the bottom wire.

A special type of wire should be used in the construction of grape trellises. This is a smooth wire and usually designated by the term self tightening. This wire is kinked or waved in long, open flat spirals. The vines cling to this type of wire better than they do to a straight, smooth wire. If this type of wire is not used it will be necessary to tighten the wires each season to avoid having the trellis sag. This applies to either type of trellis.

Some of the points to be considered in selecting the type of trellis are as follows: The Munson trellis provides better protection from the sun; the clusters are shaded practically all day and sunburn is seldom troublesome. On the other hand, when grapes are supported by the Kniffen trellis sunburn of some varieties is sometimes severe. In picking the grapes on the Munson trellis the clusters are all at practically the same height and hang beneath the wires on the trellis. On the Kniffen trellis the clusters are distributed over the canes supported by the two wires at different levels.

In pruning the work is all performed at one level on the Munson trellis. With the Kniffen trellis the growth is distributed over the wires at two levels. On the Munson trellis the bearing canes are tied to the central wire. The bearing shoots which grow from the buds on the canes left in pruning extend out on both sides of the canes and naturally fall over and are supported by the outside wires, thus forming a canopy over the fruit. It is easier to pass from row to row through the vineyard when the grapes are trained on the Munson trellis than when they are trained on the Kniffen trellis. This makes it much easier to load the fruit after it is harvested. The Kniffen trellis is cheaper and easier to construct than the Munson.

If it is decided to use the Munson trellis it will only be necessary to set the posts and string the center wire before the second season of growth starts. The cross arms and outside wires may be added later, thus distributing both the expense and labor of erecting the trellis over a two year period. If the Kniffen trellis is used it will be necessary to construct the full trellis at this time.

Summer Training

Under the Munson system of training twine should be tied to the stub which was left on the plant at pruning time and the other end tied to the center wire. If the Kniffen system is used the twine should likewise be tied to the stub and to the top wire. The twine should be stretched tight. After the shoots from the two buds which were left on the spur have made a foot of growth it will be possible to select the stronger. As this growth proceeds this shoot should be twined around the string, the other shoot being removed.

This shoot, that is retained, if being trained to the Munson system should be allowed to grow until it reaches the wire. Growth in length should be encouraged by keeping side shoots and shoots from around the base rubbed off as they appear. If the shoot which will later form the trunk of the vine does not show signs of branching by the time it reaches the wire it should be topped back at that point or slightly below so as to form a head. As shoots develop they should be trained in each direction on the wire. If the vines are to be trained according to the Kniffen system the shoot should be allowed to grow until it reaches the top wire, where it should be clipped. In many instances it will be necessary to remove shoots which develop from the base of the plant and perhaps in some instances from the sides of the plant, in order to get the length of growth necessary to reach the top wire. If any side shoots are removed care should be exercised to remove nothing which may be needed later. After the shoot has been clipped at the top wire side shoots should develop and be trained along the wires (top and bottom) two on either side of the plant, thus making four shoots to each plant. All other growth should be removed.

Under either system of training care should always be exercised to remove all shoots from the base of the plant as soon as they appear.

Fruiting Habits of the Grape

The grape vine bears its fruit near the base of the shoots, or growth of the current season. The number of clusters per shoot varies with the variety but usually average two or more. The bearing shoots arise from fruit buds on the canes. Attention should be called to the fact that a cane is one year old wood and that fruit buds will be found on no wood older than this. The most fruitful canes to be found on a plant are the medium sized ones which have a uniform diameter throughout their length. Practically every bud on a cane of this type should produce a fruit bearing shoot. Those of very small diameter or exceptionally large ones are not suitable for fruit production. A cane which tapers rapidly from the base toward the tip is usually not good for fruiting. Canes about the same diameter as a lead pencil are usually considered the most desirable although this will vary with the variety. In pruning, the proper number of buds for fruit production must be left on one year old wood. If all of the one year old wood is removed the fruit buds will all be removed and the vine will therefore bear no fruit. If all of the one year old wood is left the vine will overbear and will be unable to produce a sufficient amount of growth for a crop the following year. The clusters on plants which are not pruned or on which too much bearing wood is left at pruning time will be small, sometimes ripen unevenly, and be otherwise generally undesirable. Pruning to the proper number of fruit buds is absolutely necessary if fruit of good quality and clusters of good size are desired.

Pruning at the End of the Second Season of Growth

Munson System. At the end of the second season of growth the vines if properly cared for should consist of a straight trunk extending from the

surface of the ground to a point just below the wire, at which point the trunk should divide providing one or more canes for each side of the head. These canes will require pruning to prevent the vine overbearing and thus weakening itself while young. The amount of pruning required will vary somewhat with the amount of growth which the vines have made the previous season. In general, however, from three to six buds on each cane will be a sufficient number to leave. The larger number of buds of course being left on the vines which made the greatest growth and the smaller number on the weaker growing vines. It is important not to let the vines overbear at this time. After removing the canes which were cut off the remaining canes should be coiled loosely around the center wire and tied tightly to it between the two buds at the outer end of each cane. If the vine needs any other support to hold it up to the trellis it may be tied very loosely at a point near the head, making due allowance for growth in diameter.

If the Munson trellis has been used it will be necessary to finish erecting it sometime before growth starts. The trellis should at this time consist of a line of posts properly set and spaced, with a No. 9 or 10 wire running through them at a distance of four feet above the ground. The cross arms should now be attached by one of the methods mentioned in the description of this type of trellis. The outside trellis wires should then be put up, running them through holes in the cross arms; stapling them loosely to the upper side near the ends or fastening them in some other manner. This completes the erection of the Munson trellis.

Kniffen System. The same principles of pruning will apply to the Kniffen system. The only difference between the Munson and the Kniffen at this time is in the arrangement of the various parts of the vine on the trellis. Four canes having a diameter approximately the same as a lead pencil should be selected for fruit production. All other growth should be removed from the vine. The four canes selected for fruit production will extend along the wires on each side of the trunk. Each of these canes should be shortened to a length of two or three buds from the head of the plant. Weak vines should always be pruned more severely than strong ones. After pruning the vine will consist of a trunk and four canes. One cane will extend in either direction along the top wire and one will extend in each direction along the bottom wire. Each cane should be tied around the wires between the two outer buds.

During the following summer it will be necessary to remove all side and basal shoots which appear on the trunk. This applies to both of the above systems of pruning.

Pruning at the End of the Third Year

Munson System. At the end of the first season of bearing the vines should consist of one straight stem from the surface of the ground to where it branches just below the center wire. The trellis at this time should be fairly well covered with a number of canes which grew during the preceding summer. The best of these canes, two to four in number, should be selected



FIG. 5—AGED VINE ON MUNSON TRELLIS, BEFORE PRUNING.

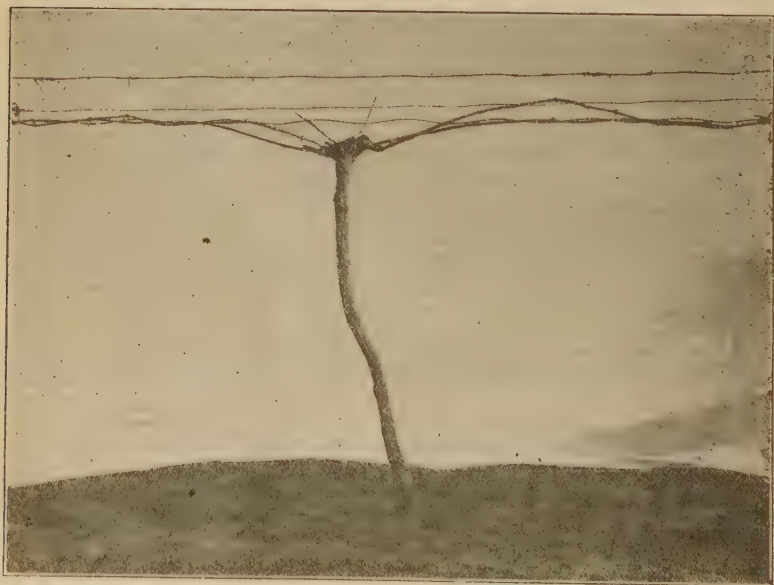


FIG. 6—AGED VINE ON MUNSON TRELLIS. SAME AS FIG. 5, AFTER PRUNING.

and left to bear the next crop. The best canes to leave are those which develop as near as possible to the head of the plant and which have made a moderate amount of growth. Canes which are very weak or extra strong and vigorous are not as likely to bear as well as those which are intermediate in size. After selecting the canes which are to be left for bearing all other growth, with the exception of two spurs, should be cut off and removed from the trellis. The canes which are left should be shortened to the proper length. The length to leave these canes varies somewhat with different varieties. From thirty to sixty buds should be left for the development of bearing shoots on each vine. The smaller number of buds should be left on the weaker and the larger number on the more vigorous vines. It may not always be possible to select canes with the same number of buds, and it may at times be necessary to divide the number of buds among three or four canes. In addition to the canes left for fruiting, two short spurs, consisting of two buds each, should be left. These spurs are for the purpose of providing canes to bear the next year's crop. They should be on opposite sides and as near the head of the plant as it is possible to secure them. After pruning and removing the prunings from the trellis the remaining canes should be tied. They should be twined carefully around the central wire and should then be tied tightly to this wire, tying between the two outer buds on each cane. With an ideal vine no more tying should be necessary. In practice, however, it may be necessary to tie loosely in one or more additional places to give support. In any additional tying due allowance should be made for growth, or the part tied may be girdled.

Kniffen System. Plants pruned to the Kniffen system consist of a trunk and four fruiting canes. Each of the fruiting canes should be eight to fifteen buds in length. In addition to the fruiting canes four short spurs, two buds in length, should be left. One spur should be on each side of the trunk near each wire. This spur should be as near the head of the plant as it is possible to secure suitable wood. The fruiting canes should be about the same diameter as a lead pencil or a little larger for some varieties. Under all circumstances medium sized canes should be selected, rather than very large or very small canes. All of the growth, with the exception of the four fruiting canes and the four two-bud spurs should be removed. Two canes each extending along the wire on opposite sides of the trunk are tied to the top wire and two canes to the bottom wire. The spurs are for the purpose of providing fruiting canes for next year's crop and should therefore be located if possible on opposite sides of the plant and near the wires. As soon as the plants are pruned the canes should be tied to the wires between the outer two buds.

The same general plan of pruning for each of the systems as outlined above should be followed year after year. The vigor of the plant must always be taken into consideration in determining how many buds should be left for fruiting. Plants which have made the least growth should be more severely pruned than those which have made the largest amount of growth. Experience and observation are necessary in order to prune for the very best results. If too many buds are left on a plant a heavy crop of fruit will follow but very little growth will take place. It is necessary to establish a balance



FIG. 7—MATURE VINE ON MUNSON TRELLIS SHOWING OLD STOCK AND YOUNG STOCK, BEFORE PRUNING.



FIG. 8—Same as FIG. 7. AFTER PRUNING FOR REMOVAL OF STOCK

between amount of fruit and annual growth so that the plant bears heavy crops and at the same time produces a sufficient amount of wood growth for a crop the following year.

After ten or twelve years plants sometimes become weakened or less vigorous, making it desirable to renew the top. This may be accomplished at any time by selecting a cane or shoot developing from the base of the plant and training it up on the wires in the same way as the original plant was trained. After this shoot has developed a sufficient amount of growth and fruiting canes to make a full crop the old trunk may be removed at the surface of the ground or near the point from which the new trunk developed. An additional reason for occasional renewal is the tendency observed in all varieties of producing fruiting wood further and further from the head of the plant with the growth of each successive year.

SPRAYING BEARING VINES

The following spray schedule for grapes is copied from Orchard Spray Calendar, Oklahoma A. and M. College Extension Division Circular No. 168:

No. and Name of Spray and When to Apply	What to Spray For	Amount and What to Use
I. Dormant Spray. When buds begin to swell.	Scale insects; anthracnose and black rot.	Lime sulphur 1 to 7 for both scale and anthracnose. If scale is absent use bordeaux 8-8-50.
II. First Summer Spray. When shoots have two leaves.	Black rot; anthracnose and flea beetle.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead.
III. Second Summer Spray. Before blossoms open.	Black rot; anthracnose and flea beetle.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead.
IV. Third Summer Spray. After blossoms fall.	Black rot; anthracnose; curculio.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead, also add ¾ pt. of nicotine sulphate if leaf hoppers or lice are present.
V. Fourth Summer Spray. Two weeks after third summer spray.	Black rot; anthracnose; curculio; leaf hopper; root worm.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead, also add ¾ pt. of nicotine sulphate if leaf hoppers or lice are present.
VI. Fifth Summer Spray. Two weeks after fourth summer spray.	Black rot; anthracnose; curculio; leaf hopper; root worm.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead, also add ¾ pt. of nicotine sulphate if leaf hoppers or lice are present.

Note: The most serious losses in grape growing come from black rot. Other diseases and insects frequently need attention. The complete schedule is necessary for best results in the control of *all* insects and diseases. However, good results may sometimes be secured from the application of three of the above sprays, viz: III, IV, and V.

At the Woodward Field Station it has not been found necessary to spray grapes for the control of black rot. Leaf hoppers and root worms have been

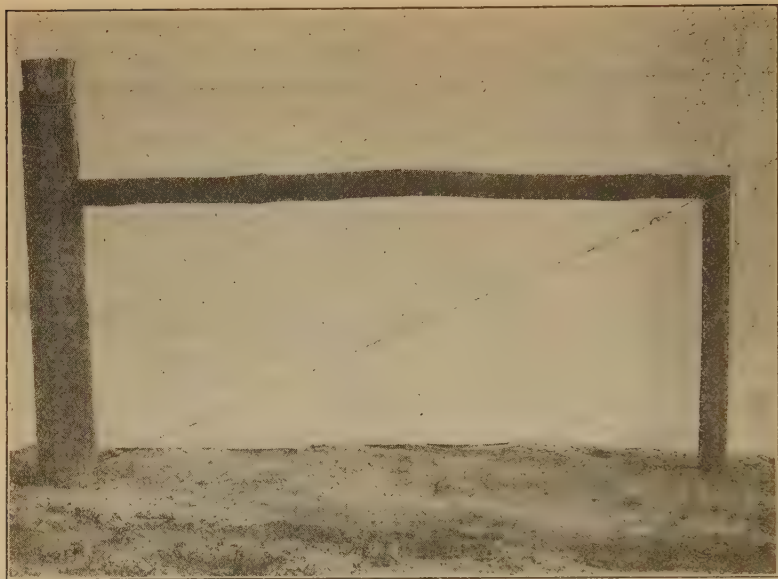
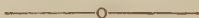


FIG. 9—BRACE USED ON END POSTS OF TRELLIS, WIRE EXTENDS AROUND BOTTOM OF POST TO "DEAD MAN" ABOUT TWO FEET FROM POST

about the only pests for which it was necessary to spray. If it is necessary to spray only for the control of such pests the schedule should be timed so that the spray will be applied when they appear. Arsenate of lead is used for the root worm and nicotine sulfate for the leaf hopper, the dilution being the same as that recommended in the spray schedule where these insects are mentioned. At Stillwater it has been found necessary, during some years, to follow the spray schedule as outlined in order to fully control black rot and other diseases and insects. At other times three sprays as designated in the note have been found adequate. The number of sprays for the control of black rot will depend to a considerable extent on climatic conditions, frequent rainfall increasing the trouble and making it necessary to apply more sprays than would be required during a year of light rainfall. The best commercial practice which we can recommend is for growers in the western part of the state to be guided by the experience of the Woodward Field Station and growers in the central and eastern part of the state to be guided by the experience of the Experiment Station at Stillwater.



HARVESTING AND PACKING

The stage of maturity at which grapes should be harvested will depend to a considerable extent on the use to be made of the fruit. If shipping to a distant market it will be necessary to harvest earlier than would be the

case if sold locally. It is desirable to leave the fruit on the vines as long as possible in order to develop the highest quality and sugar content. For the home market it may be left until the stems of the berries on the bunches begin to shrivel. For the distant market it will be necessary to pick earlier. The fruit must in every case be picked at a stage of maturity which will place it on the market in good condition. The clusters are usually removed from the vines by cutting the stems with sharp spring scissors or grape shears, or by means of a sharp knife. The clusters should be handled carefully in order to disturb the bloom as little as possible. As they are harvested they should be placed in the shade of the vines until removed to the packing shed.

It is customary to permit the clusters to wilt slightly before packing. Grapes are usually packed and marketed in Climax baskets varying in capacity from four quarts or six pounds up to twelve quarts. The clusters should be packed evenly in layers in the basket alternating shoulder ends with tip ends. The top layer should consist of well formed clusters the stems of which are covered in packing. The top should be level and the baskets packed level full or about one-half inch above the edge of the basket. Nothing except good clusters should go into the basket.

REASONS FOR VARIETY TESTING

It is a matter of common observation that in some parts of Oklahoma the Concord grape does not ripen evenly. This condition in connection with the large number of wild grape vines observed in various parts of the state led to the belief that there might be other varieties of grapes which would do better under Oklahoma conditions.

About seventy different varieties of grapes were planted on the Experiment Station farm at Stillwater during 1915 and 1916. Three vines of each variety were planted. The grapes were trained to Munson system. Unfortunately the soil is a heavy clay loam underlaid with a hard pan and thus not well adapted to grapes. The vines are planted ten by ten feet apart which is too close for many of the more vigorous varieties. Production records and blooming records were kept of the different varieties and the vines have been pruned, sprayed and cultivated in accordance with the best practice for this section.

In the spring of 1915 ten vines each of about seventy-five varieties of grapes were planted on the Woodward Field Station. The vineyard was planted on about the highest location on the Station farm in a very sandy soil which is underlaid with a sandy subsoil. It was thought that if grapes would succeed in this location they should succeed in almost any location in that section. The vines were trained to Munson system and pruned according to the recommendations for that system. These vines were planted ten by ten feet. This has been found to be much too close for many of the more vigorous varieties, as it does not give sufficient room on the trellis. Clean cultivation of the soil has been practiced, and a cover crop is planted each fall to keep the soil from blowing. Records have been kept of time of

blooming, time of ripening, evenness of ripening, weight of fruit produced on each vine in addition to several items of less importance.

Although these two tests were started independently, there are forty-six varieties which are included in both. The variation in average yield for the same variety in the two localities may in part at least be accounted for by the difference in the soil types on which the vineyards are planted, and differences in altitude and climate.

The table of yield combining the results for all varieties at the Stillwater and Woodward Experiment Stations is given below, arranged in alphabetical order. The first column in this table lists the varieties grown at both stations. The second column gives the average yields in pounds per vine at the Woodward station. These are nearly all seven year averages. The third column gives the relative rank of the varieties at the Woodward station. The highest yielding variety is indicated by number one, next highest by number two and so on. The fourth column gives the average yield in pounds per vine of the varieties at the Stillwater station. These are four and five year averages. The last column gives the relative rank of the varieties at the Stillwater station. This is arranged in the same manner as column three, that is, the highest yielding variety is indicated by number 1.

Rank of All Varieties at Woodward and Stillwater

Variety	Average Yield in Pounds Per Vine	Relative Rank at Woodward	Average Yield in Pounds Per Vine	Relative Rank at Stillwater
Albania	—	—	17.3	1
Agawam	7.1	45	1.4	65
Amerbonte	11.2	23	—	—
America	15.9	8	6.0	36
Amethyst	—	—	1.0	68
Armalaga	10.2	27	8.7	19
Augustine	—	—	1.6	63
Bailey	8.7	35	13.5	4
Banner	—	—	8.5	20
Beacon	19.0	1	4.9	47
Bell	5.1	57	—	—
Ben Hur	13.8	16	7.0	30
Blondin	8.9	34	6.8	32
Brighton	4.9	59	2.8	61
Brilliant	6.2	51	3.2	59
Campbell's Early	.9	75	1.0	67
Canada	18.8	2	—	—
Captain	16.9	4	—	—
Captivator	5.9	52	6.0	40
Carman	9.2	31	5.5	44
Catawba	15.5	10	8.9	17
Champanel	10.5	26	6.0	37
Champion	6.9	47	—	—
Clinton	12.4	18	8.8	18
Cleota	14.3	14	4.6	50
Columbia	—	—	1.5	64
Concord	6.5	49	4.8	48
Cottage	3.2	67	—	—
Croton	6.9	48	—	—
Cunningham	5.6	53	—	—
Cynthiana	—	—	10.9	11
Delaware	8.1	40	4.3	53
Delicious	—	—	8.3	23
Diamond	7.5	43	4.1	55
Duchess	11.9	20	—	—
Early Victor	4.1	64	—	—
Eclipse	—	—	4.7	49
Edna	15.1	12	8.4	22

Variety	Average Yield in Pounds Per Vine	Relative Rank at Woodward	Average Yield in Pounds Per Vine	Relative Rank at Stillwater
Ellen Scott	15.9	7	11.7	10
Elvira	15.4	11	9.0	16
Empire State	7.4	49	—	—
Ericson	—	—	8.0	24
Extra	12.1	19	13.1	5
Fern Munson	8.4	38	5.7	41
Geyer	—	—	2.6	62
Goethe	15.7	9	—	—
Gold Coin	—	—	6.0	39
Hartford	9.0	32	—	—
Hayes	1.7	72	—	—
Headlight	3.9	66	1.3	66
Herbemont	12.9	17	3.0	60
Herbert	8.1	41	9.0	15
Hicks	—	—	7.1	28
Hidalgo	1.2	73	—	—
Husmann	14.1	15	—	—
Isabella	16.8	5	9.0	14
Ives	—	—	3.7	56
Janesville	11.3	22	—	—
King	—	—	3.2	58
King Phillip	2.1	71	—	—
Last Rose	14.7	13	7.0	29
Lenoir	17.1	3	12.3	7
Lindley	9.0	33	9.3	13
Lomanto	—	—	7.4	27
Lucile	—	—	11.8	9
Lukfata	—	—	4.4	51
Lutie	4.4	62	5.0	46
Manito	16.1	6	7.6	26
Manson	5.4	56	—	—
Marguerite	9.5	29	—	—
Mericadel	8.7	36	6.0	38
Moore's Early	2.5	68	4.4	52
Muench	9.6	28	12.0	8
Muscat Rose	—	—	6.2	34
Neva	10.9	25	—	—
Niagara	7.0	46	4.3	54
Norton	8.6	37	13.0	6
Perkins	11.3	21	—	—
Pocklington	1.2	74	5.5	43
President	2.1	70	—	—
Rommel	11.2	24	—	—
Ronaldo	7.6	42	7.0	31
R. W. Munson	5.5	54	5.6	42
Salamander	—	—	9.8	12
Salem	6.3	50	—	—
Stark Star	—	—	14.1	3
Triumph	5.5	55	—	—
Valhallah	8.3	39	14.7	2
Vergennes	—	—	5.4	45
Wetumka	4.3	63	—	—
Wilder	—	—	6.3	33
Winchell	4.9	58	6.1	35
Wine King	9.5	30	8.5	21
Woodruff Red	—	—	3.5	57
Worden	4.6	60	7.9	25
Wyoming	2.6	69	—	—
Xenia	4.1	65	—	—
Xinta	4.6	61	—	—

NOTE: Where a dash (—) occurs it indicates that the variety was not grown at that station.

A Discussion of the Results of the Variety Tests

These tests have shown that there are a large number of varieties of grapes which will produce heavy annual crops in Oklahoma. No attempt has been made to estimate the marketability of any of these varieties except that in no instance is a variety recommended for planting or further trial unless it has shown sufficient quality for a market grape combined with good

color and heavy yields. The only marketable factor omitted is the shipping quality and this has not been tested at either station. Considerable variability in the average production of the varieties is noticeable at Stillwater and at Woodward. Practically two-thirds of the varieties at each station have made higher average yields than the Concord. Since these two tests are planted in different types of soil and since the varieties included in the two tests are growing under different climatic conditions the conclusion may be drawn that there are a number of varieties which under average conditions any place in the state may outyield the Concord. Many of these varieties are equal to or better in quality than the Concord and possess other qualifications which should make them acceptable in the market.

A variety of grapes suitable for commercial production in any region should be widely adaptable as to climate and to soil. Since the soil and climatic conditions under which the two vineyards have been growing are so variable a list of the varieties which have succeeded best at both stations and which possess other qualities required in a commercial grape variety should show some indication of the best varieties for commercial planting in Oklahoma. A short list, including nine varieties which have done well at both stations and arranged in the order of ripening with the color of the fruit indicated follows:

List of Most Promising Varieties at Both Stations in Order of Ripening

Very Early—	Late—
Headlight, red.	Ellen Scott, light purple.
Early—	Lenoir, black.
Manito, black.	Very Late—
Mid Season—	Catawba, late red.
Extra, black.	Last Rose, late red.
Armalaga, green.	
Edna, green.	

The Headlight, which is included in the above list, has made low average yields at both stations. If this variety is planted on a commercial scale it should not be expected to make high yields in any part of the state. It is included in the foregoing list because of its very early ripening. It ripens ten days to two weeks before any other variety mentioned as worthy of trial. At its season of ripening grapes are high priced and this variety may therefore under special conditions prove profitable. Its quality is good and it should be readily accepted by the market.

There are a number of varieties which have succeeded at one station but which have not been outstanding at both. At the Woodward Field Station the America, Beacon, Captain, and Cleota have made consistently high yields. The Beacon has made the highest average yield of any variety for the period that the vineyard has been in bearing. This variety and the others mentioned above are included within the first fourteen varieties when arranged in order of yield. The America, Beacon and Cleota have also made average yields equal to or higher than Concord at the Stillwater station and in addition to

this ripen evenly. The Captain is not included in the test at Stillwater. At the Stillwater station the Bailey, Newton, Muench and Lucile have been consistently high yielding varieties and are included within the first ten in average annual production. The Niagara, which is an old time standard green grape, does not stand high in production, but this is probably due to accidents to the crop. This variety really deserves a higher place than the records indicate and for that reason mention is made of it at this time. The Delicious is a promising variety, although it has not shown exceptionally high yields. It compares favorably with the Delaware in quality and is an improvement on the Delaware in size of cluster and berry. Among the varieties mentioned as succeeding well at Stillwater, the Bailey, Norton, Muench and Niagara are included in the Woodward tests and have given higher average yields than the Concord at that station. The Lucile and Delicious are not included in the Woodward test.

The following list is made up of the varieties mentioned heretofore and includes all of the high producing and otherwise desirable varieties which may be suitable for general market purposes in Oklahoma. Each of these varieties has shown up well at one or both stations. The Delaware has been added because it is an old standard variety of high quality and has done fairly well in both tests. The Concord is included in this list because it is a widely known standard variety and for the sake of comparison. This list is arranged in the approximate order of ripening for the various varieties. The Headlight which is the earliest variety on the list ripens in northwestern and central Oklahoma during the latter half of July. The latest varieties,



FIG. 10—VINE AND FRUIT OF BEACON.

Catawba and Last Rose, usually ripen during September in central and north-western Oklahoma; the Last Rose has ripened as late as October 10 at Woodward. Ripening dates will probably be somewhat earlier in the southern section and over a good share of the eastern portion of the state. While the varieties included in this list are arranged in their approximate order of ripening the dates of ripening vary from year to year with seasonal conditions so that the varieties as listed will be found to occasionally interchange. Soil types also affect the time of maturity, the heavier soil producing a later grape



FIG. 11—VINE AND FRUIT OF CONCORD.

than the lighter soil. Each variety in this list has been selected with the idea of choosing from the varieties under experimentation those which should prove the most profitable in commercial work. Production, quality, evenness of ripening, color, size of bunch and berry, compactness of cluster and freedom from disease have all been considered as well as any other miscellaneous factors of commercial importance which it has been possible to determine. The Lenoir and the Norton are included in this list as juice or jelly grapes. The berries of the Lenoir are too small and the quality of the Norton too low for market grapes.

Promising Varieties at One or Both Stations in Approximate Order of Ripening

Season	Variety	Color
Very Early	Headlight	Dark red
Early	Manito	Black
	Cleota	Black
	America	Black
Early Mid Season	Lucile	Red
	Beacon	Black
	Bailey	Black
	Delaware	Red
	Niagara	Green
	Captain	Black
Mid Season	Concord	Black
	Extra	Black
	Delicious	Red
	Edna	Green
	Armalaga	Green
Late	Ellen Scott	Light purple
	Norton	Black
	Lenoir	Black
	Muench	Black
Very Late	Catawba	Red
	Last Rose	Dark red

Since many of the varieties in the above list are not well known a few of the more important points in connection with each are given. This is done for the purpose of helping those who wish to select one or more varieties from a group ripening in a certain season. In the description of varieties as given below the distance at which plants should stand in the row is indicated in feet.

America—Very vigorous; cluster medium in size; loose; berries medium to small; color black; skin thin; pulp tender; high yields at Woodward, low firm; high yield at Stillwater, moderate at Woodward; use, table, market, for pollination. 14-16 feet.

Armalaga—Vines moderately vigorous; cluster large, fairly compact; berry medium size; color green; skin thin, tough; pulp tender; moderate yield at both stations; use, table and market; mid season; somewhat subject to black rot. 12-14 feet.

Bailey—Vine fairly vigorous; cluster medium to large; cluster fairly loose; berry medium to large; color black; skin medium to thin, tough; pulp rather firm; high yield at Stillwater, moderate at Woodward; use table, market, juice; mid season. 12-14 feet.

Beacon—Vine vigorous; cluster medium to large, fairly compact; inclined to shatter somewhat in picking if not handled carefully; berry medium to large; color black; skin medium, tough; pulp fairly firm; highest yielding variety at Woodward, low yields at Stillwater; use, table, market and juice; early mid-season. 12-14 feet.

Captain—Vine vigorous; clusters large size, long and cylindrical when well filled. This variety is not self fertile and very often produces poorly filled clusters unless planted with fertile varieties; berries medium in size; color black; skin medium, rather tough; pulp tender; high yields at Woodward, not included in test at Stillwater; use, table, market, juice; early mid-season. 12-14 feet.

Catawba—Vine moderately vigorous; cluster medium in size, fairly compact; berry medium to large in size; color red; skin rather thick, tough; texture moderately tender; high yields at both stations; use table, market, juice; season very late. 12-14 feet.

Cleota—Vine vigorous; cluster medium in size; fairly compact; berries medium; color black; skin thin, tender; pulp fairly firm; high yields at Woodward, low yields at Stillwater. Requires some other variety for pollination; use, table, market and juice; season, early. 14-16 feet.

Delaware—Moderately vigorous; clusters small, very compact; berries small; color red; skin thin, moderately tough; flesh tender; moderate yields at both stations; use table and market; early mid-season. 10 feet.

Delicious—Vines moderately vigorous; cluster medium in size, fairly compact, somewhat inclined to shatter; berry medium in size; red in color; skin thin, tough; pulp moderately tender; moderate yields at Stillwater, not included in test at Woodward; use, market and table; mid-season. Somewhat susceptible to black rot. 10 feet.

Edna—Vine vigorous; cluster medium to large, fairly compact; berry medium in size, green; skin medium, fairly tough; pulp tender; high yields at Woodward, moderate yield at Stillwater; use, table and market; mid season. 14-16 feet.

Ellen Scott—Vine vigorous; cluster large, compact; berry variable in size from below medium to above medium, irregular in shape because of compactness of cluster; color light purple; skin thin, tender; pulp tender, very juicy; high yields at both stations; use, market and table; season, late. 12-14 feet.

Extra—Vine vigorous; cluster medium in size, compact; berry medium in size, black; skin thin, tough; pulp moderately tender; high yields at both stations; use, market, table and juice; mid season. 14-16 feet.

Headlight—Vine medium vigorous; cluster medium to small, fairly compact; berries small to medium; dark red, almost black in color; skin thin and rather tough; pulp tender; use table and market; season very early. This variety has made low yields at both stations and is recommended only because of its extreme earliness and better quality than any of the other early grapes tried. Requires some other variety for pollination. 10 feet.

Last Rose—Vine moderately vigorous; cluster large to very large, compact; berry medium to large; color dark red; skin thin, tough; pulp moderately tender; high yields at Woodward, moderate yields at Stillwater; use, table and market; season very late. 12-14 feet.

Lenoir—This variety is often listed as Jacquez or Black Spanish by nurseries in this section. Vine vigorous; clusters large and fairly compact; berries below medium to small in size; color black; skin thin, fairly tough; pulp tender; high yields at both stations; use, juice; season, late. 12-14 feet.

Lucile—Vine fairly vigorous; clusters medium in size; compact; berries medium to large; color red; skin medium to thin, tender; pulp tough; high

yields at Stillwater, not included in test at Woodward; use, market and table; early mid season. 10-12 feet.

Manito—Vine very vigorous; size of cluster small to medium; usually rather loose; berries medium in size; color black and with whitish spots. Skin rather thin and tough; pulp tender; season early. Variety included because of its early ripening season; use, market; has made high yields at Woodward, moderate yields at Stillwater. Only partially self fertile. 12-14 feet.

Muench—Vine fairly vigorous; cluster large, very compact; berries medium in size, somewhat variable; color black; skin rather thick, tough; pulp moderately tough; high yields at Stillwater, moderate yields at Woodward; use, market; season, late. 14-16 feet.

Niagara—Moderately vigorous; clusters medium to large, compact; berries medium to large; color green; skin thin, tender; pulp moderately tender; moderate to low yields at both stations; use, market, table; early mid-season. Somewhat subject to black rot. 10 feet.

Norton—Vine vigorous; cluster medium to small, compact; berry medium to small, black; skin thin, tough; pulp firm; high yields at Stillwater, moderate yields at Woodward; use, juice; season, late. 12-14 feet.

If the records at Stillwater and Woodward are any indication any variety in the list with the exception of the Headlight should produce heavier crops than the Concord. Many of the varieties are undoubtedly adapted to commercial production in the state. The limited experience with these varieties makes it impossible to designate any one particular variety as the best one for any section of the state. Any one going into commercial grape production should carefully study this list in connection with the description of each of the varieties and choose the variety or varieties which are adapted to his needs and to his section. If the grapes are to be grown for a distant market it is best to confine the planting to a very few varieties so the crop may all be handled and marketed at approximately the same time. However, there are many local or home markets in the state in which grapes are in demand over a considerable period of time. If one were planning a vineyard for the purpose of supplying such a demand it would be advisable to select a longer list of varieties including some of those which ripen at different seasons. As noted above, varieties selected from this list may be depended upon to furnish a continuous supply of grapes from the latter portion of July until about the middle of September.

It should be kept in mind that while there is a limited demand for red and white or green grapes, the large demand is for a fairly large black grape. This is probably because of the fact that nearly everyone is familiar with the Concord which is of that type. However, one should be able to gradually educate consumers, on the local markets at least, to the fact that other types of grapes may be equal to or superior to this type.

Seven varieties in the above list are self sterile or partially so and will not produce full crops or will produce loose clusters unless other varieties blooming at the same time are planted with them. A list of these varieties together with a list of varieties which bloom at approximately the same

time any one of which should prove satisfactory as a pollinator is given below.
Varieties Needing Pollination and Fertile Varieties Blooming at Same Time

Based on six years average blooming records, Woodward Field Station.

Variety to be Pollinized	Pollinizers
America	Beacon, Delaware
Captain	Beacon
Cleota	Delaware, Beacon
Edna	Ellen Scott, Armalaga, Lenoir, Norton, Extra, Bailey Muench
Headlight	Niagara, Delaware, Catawba
Manito	Delaware
Last Rose	Extra, Bailey, Armalaga, Ellen Scott, Norton, Lenoir

The relative value of the recommended varieties may be further emphasized by naming the other varieties which have outyielded the Concord at one or both stations. These are not included in the list of recommended varieties because of one or more of the following reasons: unevenness of ripening, poor quality, loose clusters, small size of cluster or berry, susceptibility to disease or insect injury, moderate yields, cracking of the skin, shattering, lack of hardiness and drought resistance. The list is as follows: Agawan, Albania, Amerbonte, Banner, Barry, Blondin, Canada, Captivator, Carman, Champanel, Clinton, Cynthia, Duchess, Diamond, Eclipse, Elvira, Empire State, Ericson, Fern Munson, Goethe, Gold Coin, Hartford, Herbemont, Herbert, Hicks, Janesville, Lindley, Lomanto, Lutie, Marguerite, Mericadel, Muscat Rose, Neva, Perkins, Pocklington, Rommel, Ronaldo, R. W. Munson, Salamander, Stark Star, Valhallah, Vergennes, Croton, Wilder, Winchell, Wine King, Worden.

Of the above list of varieties the Carman is probably the only one which should be given further consideration as a commercial variety in Oklahoma. This variety is mentioned not because of high yields (though it has made higher average yields than the Concord at both stations) but because reports received indicate that it is used somewhat as a market variety in northeast Texas and at points farther south. Some reports have been received indicating that it does fairly well in the southern part of Oklahoma. While we do not care to recommend it for that section it might be worth trying on a limited scale. The fruit buds have not always proven winter hardy at Woodward. The type of growth made at the Stillwater station indicates that this variety is poorly adapted to a heavy soil, the vines practically always shedding a portion of their leaves during the month of August. This loss of leaves undoubtedly has had some effect on average annual production.

TREATMENT OF THE OLD VINEYARDS *

There are many old vineyards in the state which are no longer productive because they have not been properly pruned, sprayed and cultivated in recent years. With proper treatment many of these vineyards may be brought back

into normal annual production and thus give good profits to the owners. If a high percentage of the original vines are still living and are thrifty and vigorous it will usually pay to rejuvenate the vineyard.

A consideration of the growing and fruiting habits of the grape vine will make it easier to understand how to rejuvenate old vineyards. As growth develops from year to year in an unpruned or improperly pruned vineyard, the fruiting wood consisting of one year old canes becomes farther and farther removed from the head of the plant. More annual growth develops at or near the ends of the old vines than on the trunk or other parts of the vine. As growth progresses from year to year an increasing number of canes develop and the length of each cane decreases. This soon develops a thick matted vine consisting of weak spindly shoots or canes far removed from the head of the vine. This undesirable distribution of the wood on the trellis is one of the reasons for the necessity of rejuvenation.

The length of time required for rejuvenation of an old vineyard will depend upon the pruning methods employed. If the vineyard is producing crops of fruit of any size it will be best to take two or three years for complete rejuvenation. However, if very little fruit is being produced rejuvenation may be accomplished in one year by sacrificing all of the fruit, in which case the old vines should be cut off at the top of the ground. When so treated shoots will develop which should be trained by the methods outlined in this bulletin. These shoots may be expected to develop into fruiting canes for a crop the following summer. A different type of pruning should be followed in vineyards which are producing any considerable amount of fruit. In pruning a vineyard of this type it should always be kept in mind that the fruiting wood consists of one year old canes. Fruiting canes for bearing a crop should be selected as near to the head of the vine as it is possible to secure the proper amount of one year old wood. All other growth should be removed. In most instances this will mean that long vines must be untangled and pulled away from the trellis. If the old plant consists of a number of vines or stems this number should be reduced so that only one or two are left. After the vines are pruned and the prunings removed from the vineyard all posts should be examined, replacing those which are missing or decayed. The end post should be braced and the wire tightened. As soon as growth begins in the spring cultivation and other methods of vineyard management as outlined in this bulletin should be started.

Under either of the methods of pruning outlined above it will be necessary to remove a large number of suckers and useless shoots which develop from the base of the vine. It is desirable to renew all of the top as quickly as possible. If pruning for fruit production shoots will usually develop from the base of the vine and may be trained in such a way as to form the trunk of the new vine. This selection of a cane for a new trunk is made when pruning the second year. In many instances it will be possible to secure a cane when pruning the plant the first year. If such a cane is found growing up through an old matted vine it should always be given preference to any other type of growth found on such a vine. As soon as possible the vines

should be brought into the proper shape and trained on either type of trellis (Munson or Kniffen) which may be selected.

Some of the varieties in these old vineyards may be unsuited to Oklahoma conditions. If such is the case and if the vines and roots are strong and vigorous it may be possible to change to profitable varieties by grafting. In grafting, the tools required are a good sharp knife, a saw and chisel. A grafting chisel is to be preferred if much grafting is to be done as this has a blade for making a split in the stock to be grafted and also a wedge for opening the split to receive the scion. In grafting such varieties as Concord the old trunk should be cut off at or below the surface of the ground. This should be done so that the scion will eventually become established on its own roots. It will be necessary to make this cut high enough above the roots to leave a straight grained portion of the trunk so that it will split fairly straight for about two inches. The same type of wood as that selected for fruiting canes should be chosen from the variety with which it is desired to graft the old vineyard. The soil should be dug away from around the plant to be grafted so as to select the proper place to cut off the trunk. After the trunk is cut off it should be split with a chisel and a wedge inserted to hold the two halves apart. A scion or piece of wood having two or three buds should be cut from the wood selected to be grafted. This should be cut far enough below the lower bud so as to give room to cut a wedge at the lower end of the scion. This wedge should be made with two long sloping cuts one on each side of the scion and should be made so that the wedge is slightly thinner on the side away from the bud thus permitting all of the pressure of the stock to be placed on the outer edges of the scion. The scion must be placed in the split portion of the stock so that the cambium layer or inner bark of the stock comes in contact with the cambium of the scion or there will be no possibility of the graft growing. In grafting old vines the stock is usually stiff enough to hold the scion in place and no tying is necessary. If the stock is large enough two scions may be inserted, thus doubling the chances for success. It is not necessary to cover the cut surfaces with grafting wax, but the soil should be carefully mounded up over the entire graft, covering to slightly above the top of the scion. This should be done very carefully so as not to disturb the scion. When vines are grafted a large number of shoots will usually start from the roots below the graft. These should all be removed as soon as they show through the surface so as to throw the strength of the plant into the graft. The graft will not usually start to grow as early as ungrafted vines and it is good practice to keep all of the shoots off of the stock for at least a month or six weeks to give the graft a chance to start. If it does grow they should be kept off during the entire season and succeeding seasons. If the graft does not start growth after a reasonable length of time the shoots should be allowed to develop and all but the strongest one removed and this one may be allowed to grow for grafting the next season. The wood to be used for grafting should be selected as early in the dormant season as convenient and stored in a cool place in damp sand until it is used. Probably the best time for grafting is just as the buds commence

to swell. It may be done later but is not likely to be as successful. If the work is not done at this time it should be done considerably earlier and before the heavy sap flow commences.

SUMMARY

Directions are given for the selection of soil; laying out the vineyard; planting; pruning and training.

Climatic conditions in Oklahoma are suitable for the commercial production of grapes.

The Concord, which has been so extensively planted in this state, has many faults, chief of which is uneven ripening.

There are many varieties of grapes which appear to bear heavier crops than the Concord.

Several of these varieties are suggested and recommended for trial as substitutes for the Concord in commercial work.

No particular variety can be recommended as best because of limited experience with them.

Fall planting is recommended for the central and eastern part of Oklahoma.

Spring planting is recommended for the western section of the state.

Prune the vines annually, leaving two to four canes each of which should be from eight to fifteen buds in length, depending on the vigor of the variety and the strength of the individual plant.

Either one of two systems—Munson or Kniffen—may be chosen for training the vines.

Cultivation should be thorough and regular from early spring until September at which time a cover crop of wheat or rye should be sown.

Spraying is necessary for the control of insects and diseases.

There are many neglected vineyards in this state which may be made to yield good crops by proper methods of management.

